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ABSTRACT

This is a summary of the main findings and conclusions resulting from a study conducted to estimate the number of new teachers the District of Columbia Public Schools (DCPS) will require to staff its classrooms over the next seven years. The methodology of this study, including the construction of model-to-project requirements, involved analysis of enrollment trends in DCPS over the past 10 years, teacher attrition patterns over the past five years, population and migration trends for the District of Columbia, and pupil-teacher ratio policies set by the Board of Education. The sources of data for the analysis were the computerized files on DCPS teachers maintained by the school system and available census track data for the District of Columbia. Twelve tables and 14 figures are included. (JD)

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District of Columbia Public Schools

A Study of the Supply and Demand for Public School Teachers in the District of Columbia 1988-1994

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EXECUTIVE SUMMARY

This is a summary of the main findings and conclusions resulting from a study conducted to estimate the number of new teachers the District of Columbia Public Schools (DCPS) will require to staff its classrooms over the next seven years.

The methodology of this study, including the construction of a model to project requirements, involved the analysis of enrollment trends in DCPS over the past 10 years, teacher attrition patterns over the past five years, population and migration trends for the District of Columbia, and pupil-teacher ratio policies set by the Board of Education. The sources of data for the analysis were the computerized files on DCPS teachers maintained by the school system and available census track data for the District of Columbia.

FINDINGS

Increasing Enrollments in the Elementary Grades

Elementary enrollments in DCPS are projected to rise over the next seven years. Increases in enrollments at the pre-k and kindergarten levels over the past two years reflect the effects of a recent increase in birth rates and a somewhat stable net rate of migration in the District. This baby boomlet that is now entering the early elementary grades is expected to steadily increase the enrollments over the elementary grade structure during the next seven years. With class size (pupil-teacher ratios) remaining the same, this study projects steady increases in the number of new teachers needed to meet elementary enrollment levels from average levels of about 200 new teachers in the past two years to almost 300 new teachers in 1993. Any changes in pupil-teacher ratio requirements in grades one and two, increased teacher attrition rates, or changes in other population demographics for the District of Columbia (including any increases in migrations into the District, such as we might anticipate from those immigrating from Centeral America) will require hiring more than the projected number of elementary teachers.

Junior and Senior High Enrollments

The study also projected the requirements for junior and senior high school teachers over the next seven years. In general, the requirements for new teachers are both smaller in magnitude and show smaller increases from historicals levels than for the elementary grades. At the junior high level hiring requirements have averaged about 50 new teachers per year for the last five years. This will grow steadily to slightly over 100 per year as the baby boom cohort passes through the elementary grades in 1995. This rate of increase does not include allowances for reduced class size in English and mathematics.

At the senior high level the picture is very similar. Average annual hiring has been approximately 40 new teachers a year. If class sizes do not decline for English and mathematics, the projections call for a slight rise to 65 new teachers a year through 1993, when the first wavelet of the baby boom will enter the ninth grade.

Teacher Attrition Rates

In addition to the projected enrollment increases discussed above, two other factors will influence the number of new teachers that will be needed over the next seven years: teacher attrition rates and Board mandated class size policies. Attrition rates for DCPS teacher are currently very low due to the fact that almost all teachers are in their mid-career phase. Only 4 percent of DCPS teachers are below 30 years of age, and 12 percent are retirement eligible. This means that 84 percent of the teachers are between 30 and 55, a career phase when voluntary attrition rates are very low. However, this will change over the next seven years as this mid-career group moves toward retirement. About 44 percent of the current teaching force will be retirement eligible within the next 10 years, leading to increases in teacher attrition at the same time that the baby boom is passing through the school system.

The fact that DCPS will be hiring more new teachers in the next several years poses yet another problem for the school system. Demographic studies of attrition among teachers show that new teachers always have higher rates of attrition than more experienced teachers.[1]

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[1]Grissmer, David W., and Sheila Nataraj Kirby, *Teacher Attrition*, The RAND Corporation, R-3512-CSTP, August 1987.

This is especially true of teachers in their first three years of teaching. For example, attrition rates for younger teachers in DCPS, those between the ages of 22 and 29, range between 10 and 25 percent over the five year period, 1981 through 1986, compared to an average annual attrition of just under 6 percent. Since increases in enrollments and teacher retirements will force the school system to hire more new teachers over the next seven years, it also can expect higher turn-over rates than it is currently experiencing.

The Effects of Reducing Class Sizes

At the same time as enrollments are increasing and teacher retirement rates are expected to edge upwards, the Board of Education is attempting to achieve smaller class sizes in pre-kindergarten through grade two and in English and mathematics classes in the junior and senior high schools. These reductions in class size could create large increases in the demand for new teachers. For stance, if DCPS attempts in 1988 to achieve the mandated smaller elementary class sizes in a single year, 350 new elementary teachers would have to be hired over and above the projected 250 teachers needed for that year. Implementing the Board's class size reduction policies in the junior and senior high schools will add an additional hiring requirement of about 100 new English and mathematics teachers beyond those already projected for the period.

Characteristics of New and Returning Teachers:

The age distribution of the teachers hired during the period 1981-1986 reveals that most of the new or returning teachers hired during this period are between 30 and 45 years of age; few new teachers hired in this period are under age 30. A significant number of those hired are between 45 and 65, particularly the group of teachers hired in 1986-87. Part of the increased demand for new teachers in the last two years, then, appears to have been satisfied by older "returning" teachers: those returning from retirement, experienced paraprofessionals in the system who meet minimum certification requirements, teachers "RIFed" in 1981, and others returning to teaching from parenting roles. This pool of older, more experienced teachers,

however, is not limitless and is likely to dry up as the need to recruit new teachers becomes more critical. Once this pool of older teachers is exhausted the school system will have to recruit in more competitive labor markets.

POLICY IMPLICATIONS

The school system faces an unprecedented challenge in recruiting and retaining sufficient teachers to meet expanding enrollments in the face of a larger number of pending teacher retirements, higher attrition rates among the new teachers it must hire, and the requirements of Board mandated class size reduction policies. To some extent the system already has begun responding to this challenge by considering various incentives to attract and retain sufficient numbers of qualified new teachers to meet its staffing needs.

Recruitment

Even without implementation of Board mandated reductions in the pupil-teacher ratios of certain classes it appears certain that DCPS will need to recruit more new teachers than it has been used to hiring since the late 1970s. Over the past three years the school system has been able to staff its vacant classroom teacher positions by drawing on the reserve pool of available teachers largely made up of temporary hires, substitutes, and former DCPS teachers caught in the RIF of 1980-81, and by intensive recruitment efforts in regional teacher training institutions. This reserve pool of teachers available in the District of Columbia, however, may be drying up as more of these "RIFed" and temporary teachers are drawn into full-time teaching positions in DCPS and other school districts in the region. The only alternative to meeting staffing requirements will be to intensify recruitment efforts for newly trained teacher recruits.

Recent national studies of the supply of new teachers paint a dark picture, especially for urban school districts. While the number of students enrolled in teacher education programs has increased slightly over the past two years, demand for new teachers among urban school districts in the mid-Atlantic region will surely exceed supply. To worsen matters, suburban and rural school districts in the region will

also experience an increase in demand for new teachers, setting up stiff competition between urban and suburban/rural school districts for the limited supply of qualified new teachers coming out of regional teacher training programs.

A recent report by the American Association of Colleges for Teacher Education (AACTE) outlines what appears to be two disturbing conditions in the supply of new teachers that may tax our recruitment efforts. In a national study of teacher education majors, AACTE found that 82 percent of the prospective teachers come from suburban or rural communities. The over whelming majority of these potential teachers indicated they would *not* teach in large urban school systems. The same study found that only 5 percent of the nation's prospective teachers were black. With suburban school districts anxiously trying to recruit minority teachers to meet community demands and court mandates, the actual number of newly trained minority teachers available to large urban school districts may be shrinking.

This increased demand juxtaposed against a limited supply of new teachers clearly points to the use of incentive packages to attract a sufficient number of highly qualified new teachers to teaching in DCPS. Similar incentives will be needed to reduce the attrition among the cadre of new teachers hired. The Board has already put in place several incentive programs designed to attract new teachers. It may need to consider other, perhaps more costly, incentives as the 1980's comes to a close.

Teacher Testing

The Board of Education currently is considering adoption of a policy requiring competency tests for all new teachers. Decisions regarding the testing policy are certain to have an important impact on its efforts to recruit new teachers. While the quality of new teachers is as important as the quantity we are able to hire, we must be prepared to face the possibility that a sizable number of the applicants will not be able to obtain full certification because of low test scores. We either redouble our efforts to attract and recruit applicants, or we put in place programs to assist new teachers to attain passing scores on the competency tests now under development.

Pupil-Teacher Ratios

The school system may have to consider phasing in its efforts to reduce pupil-teacher ratios as a mechanism to reduce class sizes in certain elementary and secondary classes. If in 1988, for example, DCPS attempts to implement reduced pupil-teacher ratios in the designated elementary classrooms it will require hiring approximately 600 new teachers in a single year. Maintaining quality and recruiting 600 new teachers may be impossible. Stretching out the hiring of 375 (added) new teachers to meet the pupil-teacher ratio requirements over three years would significantly reduce the recruitment burden and allow for better screening of new teachers and quality hiring. It also would reduce the resources needed to implement the policy, smoothing out added salary costs over a three year period.

Delaying Teacher Retirement

In meeting the significantly increased requirements for teachers in DCPS over the next decade, it may be important to consider adopting policies which would delay retirement decisions for many of the teachers in the system nearing retirement eligibility. Offering enhanced retirement benefits for additional years of service and higher salaries might serve to retain many of these teachers in the system for additional years. Such a policy also might allow DCPS more time to recruit and select new teachers, thereby gradually building a younger, higher quality teaching force. However, such a policy depends on the comparable costs and benefits of retaining older teachers versus the costs of hiring a large number of new teachers. Retaining retirement eligible teachers carries with it added costs from higher salaries, increased costs for retirement benefits, and additional costs for incentives to induce older teachers to stay. There also may be some tradeoffs in terms of the performance of teachers who have been in the classroom for more than 25 years. With regard to opting for increased efforts to recruit new teachers, the salary costs are reduced, as are the costs associated with retirement benefits, but there will be increases in recruitment costs, as well as those associated with recruitment incentives.

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INTRODUCTION

The District of Columbic Public School (DCPS) system faces a formidable task over the next 10 years. It must recruit and retain a significantly larger teaching force while maintaining or improving the quality of that force. The size of the teaching force required will expand because of projected enrollment increases beginning at elementary levels and moving through senior high levels, mandated smaller class sizes in lower grades and in English and mathematics at higher levels, and projected higher attrition rates among DCPS current teachers. These changes will be occurring at a time when most other school districts will also be increasing their staffing, so competition for teachers--particularly at elementary levels--will intensify.

This study was undertaken by DCPS in order to project the annual need for hiring new teachers over the next 6 years and to provide an improved teacher planning system for questions related to teacher supply and demand. Projecting hiring needs over the near term is a critical basis for making decisions regarding teacher salary levels, resources required for recruiting teachers, and programmatic resources for addressing issues of teacher attrition. Major changes in policy will be required to successfully recruit and retain the teachers necessary to meet enrollment increases and smaller class sizes.

This report first briefly describes the methods used to derive new teacher demand. Next, the key assumptions used in deriving the need for new teachers are provided, including a discussion of the current teaching force, enrollment projections, teacher attrition rates, student/teacher ratios and profiles of new teachers hired recently. The final section discusses the projections of new teachers required.

METHODS USED IN THE ANALYSIS

DCPS teacher records from 1981 to 1986 have been used to derive profiles of current, departing and new teachers for each year. These profiles have been developed for teachers by level taught, subject, age, and sex. Changes in the teaching force over the last five years can be described with these data as well as trends in attrition rates and types of new teachers hired.

Computerized data on student enrollments by grade over the last 11 years, student teacher ratios, fertility and migration trends nationally and in the District of Columbia, and projected changes in class sizes over the next few years have also been gathered. These data have been combined into a model implemented on a personal computer that allows estimation of the required number of teachers by level and subject and required new teachers to be hired. The model is capable of showing changes in these numbers as different assumptions are made about class size, enrollments and teacher attrition.

THE CURRENT TEACHING FORCE

The most striking characteristics of the DCPS teaching force is that over 87 percent of the teachers are over 35 years of age (see Table 1). Only 4 percent of the teachers are in their twenties. This distribution indicates a force rich in experience with most near or at the top of the pay scale. Attrition rates for teachers are currently very low due to the stability of mid-career and older teachers. However, retirements will be increasing over the next 10 years as many of these teachers pass age 55. About 44 percent of the current teaching force will be retirement eligible within the next 10 years.

The low number of younger teachers is caused partly by the low demand for teachers over the last 10 years, as well as actual reductions in force (RIFs) during the early 1980's. This reduction in force fell heavily on younger teachers; and few younger teachers have returned or been hired. The absence of younger teachers may also indicate the difficulty of hiring younger teachers in the District, either because of lack of competitive salaries or because of the perception of more difficult working conditions by potential teachers. Alternatively, it may indicate a preference by the District to hire experienced teachers.

Regardless of the reasons behind the low number of new young teachers in DCPS, this situation will have to change if DCPS is to successfully meet its hiring needs over the next 6 years. It is unlikely that DCPS can find sufficient numbers of new mid-career teachers. There will have to be a focus on hiring and keeping new teachers with fewer years of experience. DCPS should initiate an

Table 1

A PROFILE OF D. C. PUBLIC SCHOOL TEACHERS
1981-1985 BY SELECTED VARIABLES

	Year (Percent of total)				
	1981	1982	1983	1984	1985
CATEGORY					
Elementary school	49.4	98.8	49.0	49.4	49.3
Junior high school	19.0	19.6	19.1	18.9	18.5
Senior high school	13.7	14.1	14.5	14.2	13.9
Career education	3.4	3.4	3.1	3.2	3.2
Special education	10.3	10.3	10.3	10.4	11.1
Other (codes F-K)	4.2	3.8	4.0	3.9	4.0
SUBJECT					
Classroom Instruction					
Elementary 1-6	26.6	26.4	27.4	27.7	26.7
Preschool	6.7	6.7	6.8	6.7	7.2
Art and music	4.3	4.6	4.6	4.6	4.6
Physical education	4.4	4.3	4.2	4.1	3.9
Mathematics	6.5	6.4	6.0	6.1	5.9
Science	4.6	4.8	4.8	4.9	4.9
English	6.0	6.1	6.0	5.7	5.8
Social studies	4.1	3.9	3.7	3.8	3.6
Reading	3.9	3.4	3.2	2.8	2.7
Foreign language	1.5	1.6	1.6	1.7	1.8
Bilingual instruction	0.5	0.5	0.5	0.6	0.9
Resource programs	2.3	3.3	3.1	3.5	3.7
Other	1.1	0.7	0.6	0.4	0.5
Total					
Small Group Instruction	9.1	8.8	8.9	9.0	9.5
Vocational/Technical Instruction	6.7	6.8	6.9	6.9	6.6
General Instructional Support					
Counselors	4.1	4.2	4.0	4.0	3.9
Librarians	2.9	3.1	3.0	3.1	3.0
Other	0.4	0.8	0.9	0.8	0.9
Total					

Table 1 (Continued)

A PROFILE OF D. C. PUBLIC SCHOOL TEACHERS
1981-1985 BY SELECTED VARIABLES

	Year (Percent of total)				
	1981	1982	1983	1984	1985
All Others	4.3	3.7	3.8	3.7	3.9
AGE					
21-25 years	0.7	0.5	0.6	0.3	0.7
26-30 years	5.5	4.0	4.1	3.4	3.5
31-35 years	17.8	15.2	12.2	10.3	8.8
36-40 years	23.1	23.7	24.6	22.7	21.1
41-45 years	16.6	17.5	18.2	20.0	22.0
46-50 years	15.5	15.7	16.0	16.9	16.5
51-55 years	11.4	12.8	13.2	14.2	15.0
56-60 years	6.0	6.7	7.1	7.9	8.2
61-65 years	2.4	2.7	3.1	3.3	3.4
65+ years	1.1	1.3	1.1	1.0	0.8
EDUCATION LEVEL					
B.A.	16.7	16.7	15.7	15.1	14.4
B.A. + 15 credits	10.8	10.3	10.2	10.1	9.7
M.A.	48.6	48.8	49.0	49.2	49.7
M.A. + 30 credits	15.6	15.8	16.2	16.2	16.7
Ph.D	8.2	8.4	9.0	9.3	9.5
Total	100.0	100.0	100.0	100.0	100.0
(N)	(6,012)	(5,778)	(5,852)	(5,762)	(5,799)

internal review focused on hiring younger teachers. This review should examine historical experience to determine whether:

- younger teachers have not been recruited due to a preference for mid career teachers; and
- younger teachers have been recruited, but acceptance of job offers have been low.

The total number of teachers employed by DCPS has declined slightly from 6,012 in 1981-82 to 5,799 in the 1985-86 school year. Elementary schools employ almost one-half of DCPS Teachers, with 19 percent working at the junior high levels, 14 percent at senior high levels and 11 percent in special education. These percentages have changed little over the last 5 years.

Figures 1 and 2 display the age distributions of the elementary, junior, senior and special education teachers. The data indicate that special education teachers have a distinctly younger profile than the others, and that special education teachers constitute a significant share of the younger teachers. Elementary teachers have a larger share of individuals nearing retirement than either junior or senior high teachers. About 53 percent of elementary teachers are at or within 10 years of retirement eligibility compared to 44 percent for all teachers.

In meeting the significantly increased requirements for elementary school teachers in the next 10 years, it may be important to adapt policies which will delay retirement decisions for many of these retirement eligible individuals. Over one-half will be eligible for retirement within the next 10 years and retaining these teachers for extra years of service between ages of 55 and 65 could significantly decrease recruiting requirements and increase the chances of achieving smaller class sizes. Offering enhanced retirement benefits for additional years and higher salary for additional years of teaching might keep many teachers for additional years. Such a strategy would also allow more time to recruit high quality, new, younger teachers and gradually build a younger teaching force.

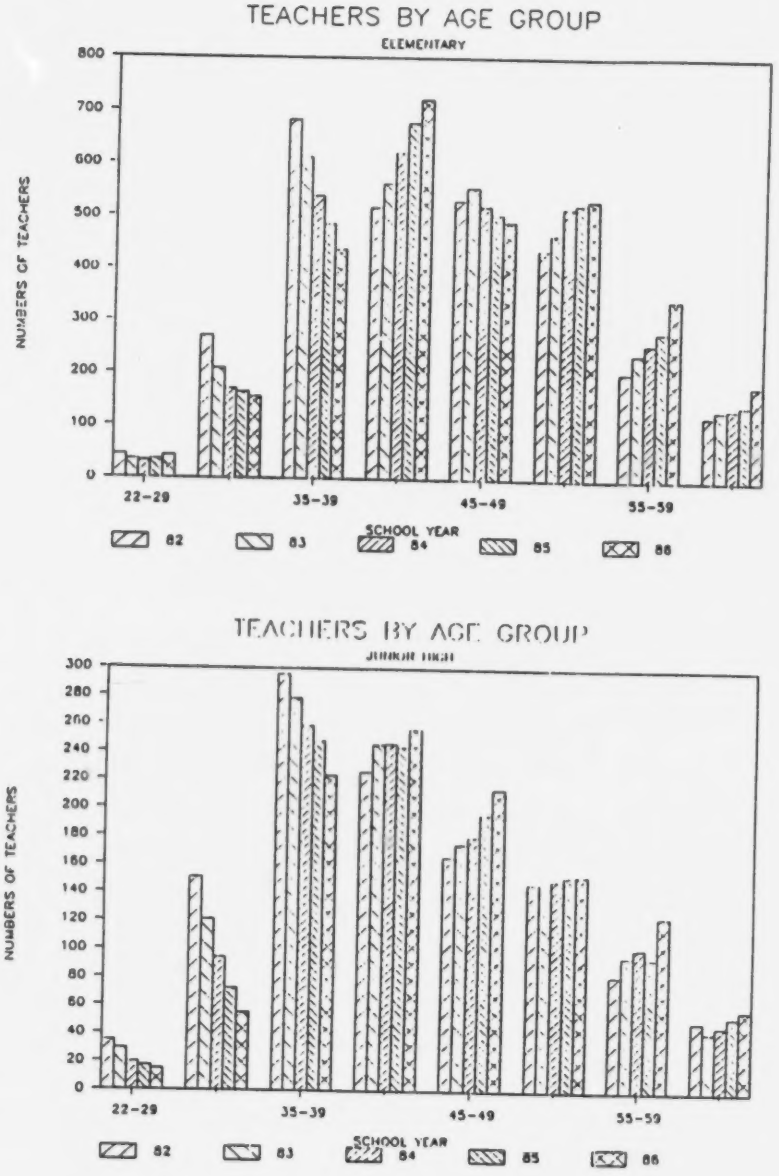


Fig. 1 -- Elementary and Junior High School Teachers By Age and Year

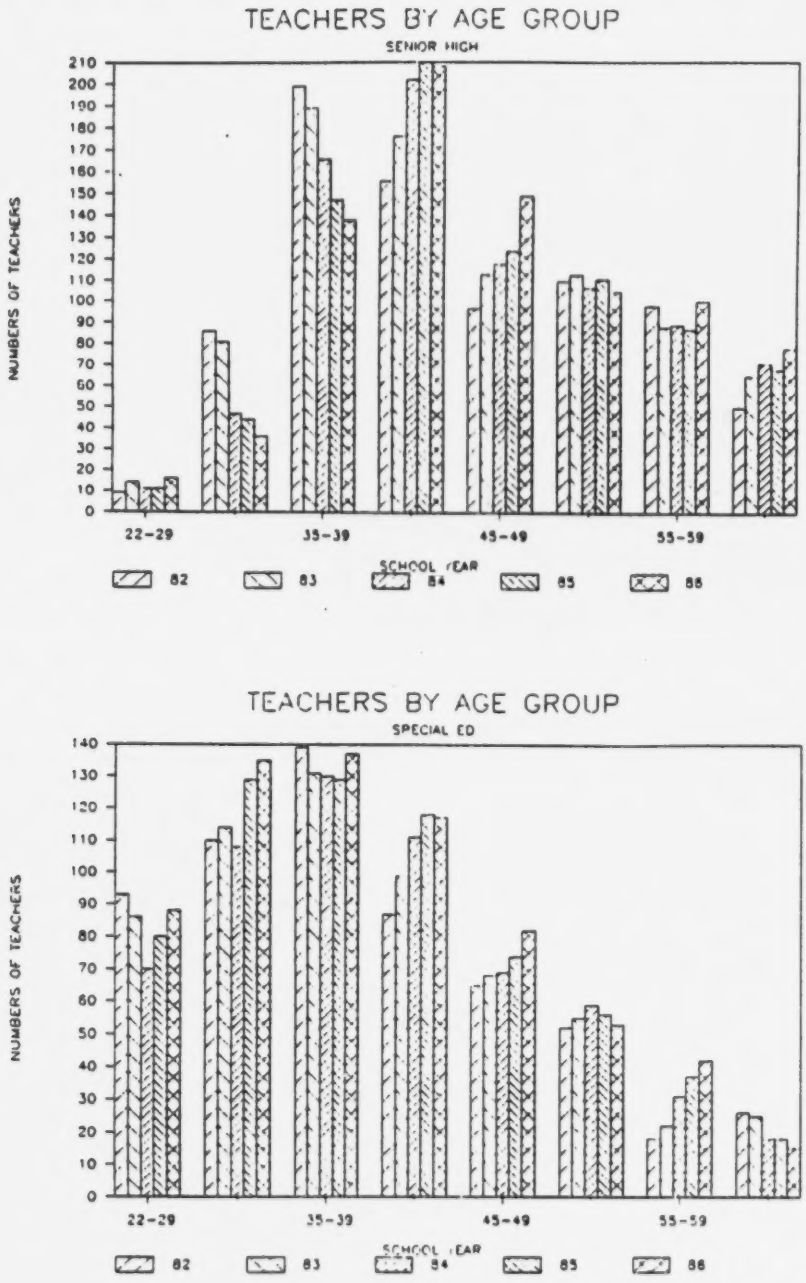


Fig. 2 -- Senior High and Special Education Teachers by Age and Year

However, the desirability of introducing policies designed to delay retirement or attract retirees back to teaching depends on the costs and benefits of hiring younger or older teachers. Keeping older teachers longer will mean higher salary costs, higher retirement costs, and the additional costs of inducing more older teachers to stay. For instance an annual bonus or other inducement may be needed to raise the number of teachers delaying retirement. Cost considerations of meeting needs through hiring younger teachers include higher recruiting costs, lower salary but immediate retirement costs for older teachers. Besides the costs, judgements must be made concerning the quality of older and younger teachers. Is the competence and effectiveness of those delaying retirement greater than that of its new younger teachers hired? These are obvious questions that must be considered before delayed retirement policies are implemented.

Demand for junior and senior high teachers--outside of mathematics and English--will generally remain steady in the next 2-4 years. Delayed retirement incentives for these groups probably would not be necessary. However, the smaller mandated class sizes in English and mathematics will increase demand for teachers of these subjects significantly, and delayed retirement incentives might be helpful. It will be important to determine if current personnel policies and union contracts would allow offering delayed retirement incentives for only certain groups of teachers. If not, this could add significantly to the costs of implementing a delayed retirement option.

TEACHER ATTRITION PATTERNS

Annual teacher attrition has averaged 5.75 percent over the last five years (see Table 2). Its highest level was 6.4 percent in 1981-82 and 1984-85, and its lowest level was 4.7 percent in 1985-86. Teacher attrition rates vary by age in an expected pattern of higher attrition for younger and older teachers, and low levels for mid-career teachers (see Table 3). The lowest attrition occurs for teachers between ages 40 to 50 where 2 to 3 percent annual attrition occurs for each year between 1981 to 1985. Younger teachers and retirement eligible teachers experience annual attrition rates between 10 and 25 percent.

Table 2

ATTRITION AMONG D. C. PUBLIC SCHOOL TEACHERS, 1981-1985

Year	Total	Percent Attrition
1981	5,966	6.39
1982	5,721	5.84
1983	5,804	5.39
1984	5,360	6.44
1985	5,483	4.69
Average	--	5.75

Table 3

AGE-SPECIFIC ATTRITION RATES FOR D. C. PUBLIC SCHOOL TEACHERS, 1981-1985

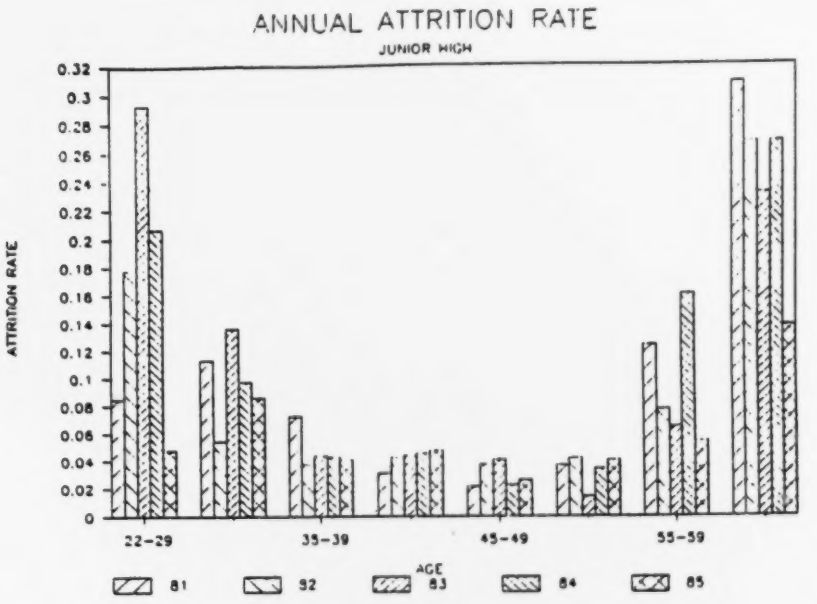
Age	Year				
	1981	1982	1983	1984	1985
21-25 years	7.5	7.1	15.6	23.5	10.3
26-30 years	12.2	12 9	15.2	8.8	8.9
31-35 years	7.3	7.5	5.3	6.6	6.3
36-40 years	6.5	4.3	4.4	4.5	3.4
41-45 years	3.7	4.6	3.6	3.8	4.4
46-50 years	3.0	3.1	2.4	2.8	2.8
51-55 years	4.1	2.9	3.6	6.3	3.9
56-60 years	9.1	8.6	7.5	11.7	5.5
61-65 years	12.3	14.7	15.1	22.0	9.8
65+ years	44.4	43.1	41.3	57.6	26.5

It should be noted that attrition rates dropped dramatically for retirement eligible teachers in 1985-86 compared to all previous years (see Figs. 3 and 4). This may be an indication that the increasing demand for teachers is beginning to be felt, and principals and personnel specialists may be successfully delaying retirement of some teachers. Since no incentives have yet been offered for delaying retirement, this would have to have been done simply by simple persuasion. Offering of incentives would probably result in additional teachers delaying retirement. While we cannot estimate either the costs or the number that would choose delayed retirement from current data, this recent increase in retirements may be an indication that teachers will respond favorably to incentives for delayed retirement. Further investigation in this area should be conducted.

Elementary teachers generally have the lowest attrition rates and lowest rate of transfer to other teaching positions (see Table 4 and Figs. 5 and 6). Their attrition rates are generally one or two points lower than those of junior and senior high teachers. Junior high school teachers have higher attrition and transfer rates than senior high teachers. The highest attrition rates are for special and career education teachers. Their annual attrition rates are in the 6 to 9 percent range.

With subject area specialists the highest attrition rates are among foreign language and bilingual teachers (see Table 5). In recent years annual attrition rates between 10 and 15 percent were common. Other subject area specialist with consistently higher than average attrition rates are mathematics and science teachers, art and music teachers and counselors. Elementary classroom teachers consistently have among the lowest attrition rates.

Males have consistently higher attrition rates than females at every teaching level except high school (see Table 6). Male attrition rates are thirty percent higher for elementary school teachers, and twenty percent higher for junior high teachers. At the senior high level, female rates are about 11 percent higher than males. Young male teachers are at significantly greater risk of leaving than young female teachers (see Table 7). Males below age 30 have 50 percent higher



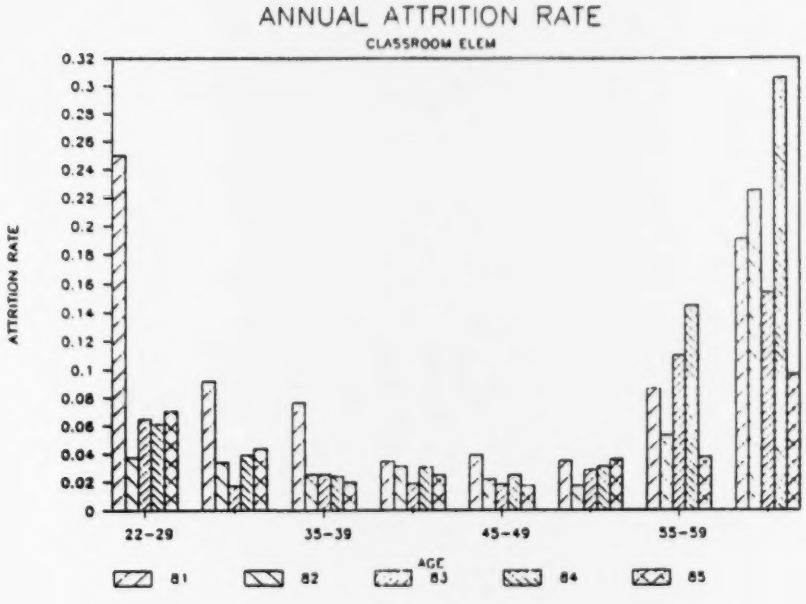


Fig. 3 -- Elementary and Junior High Teacher Attrition Rates by Age and Year

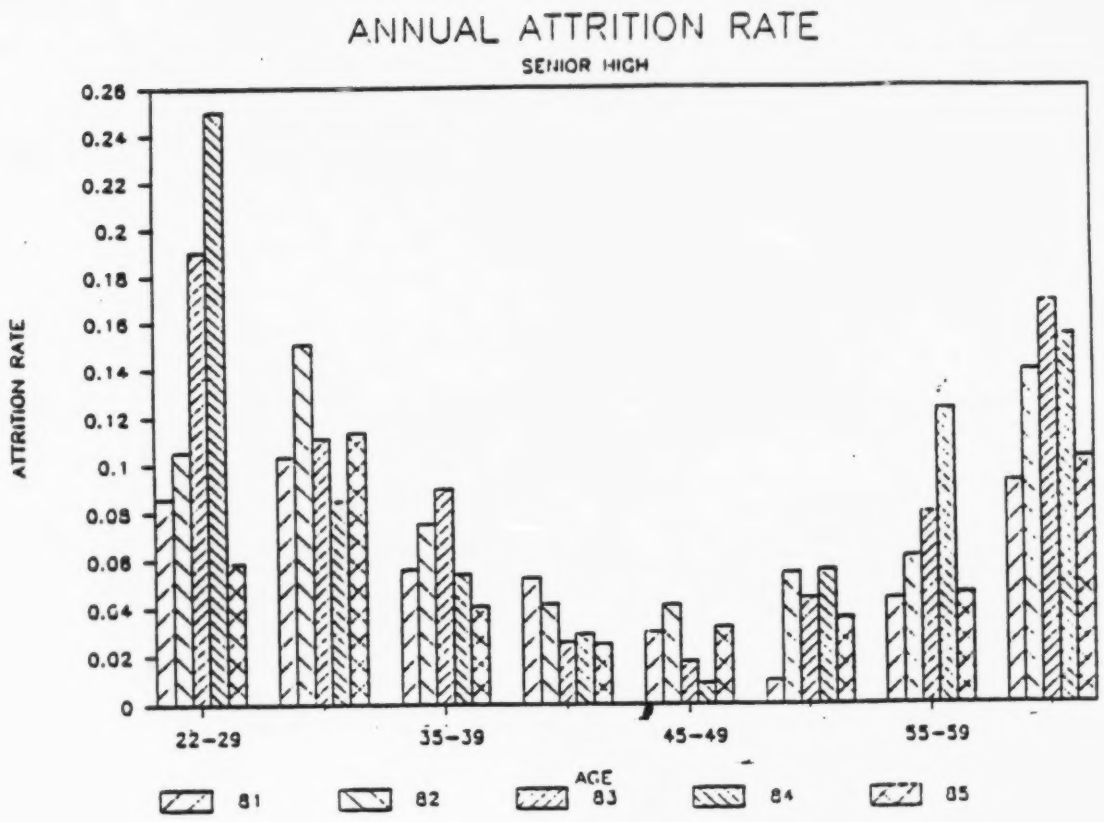


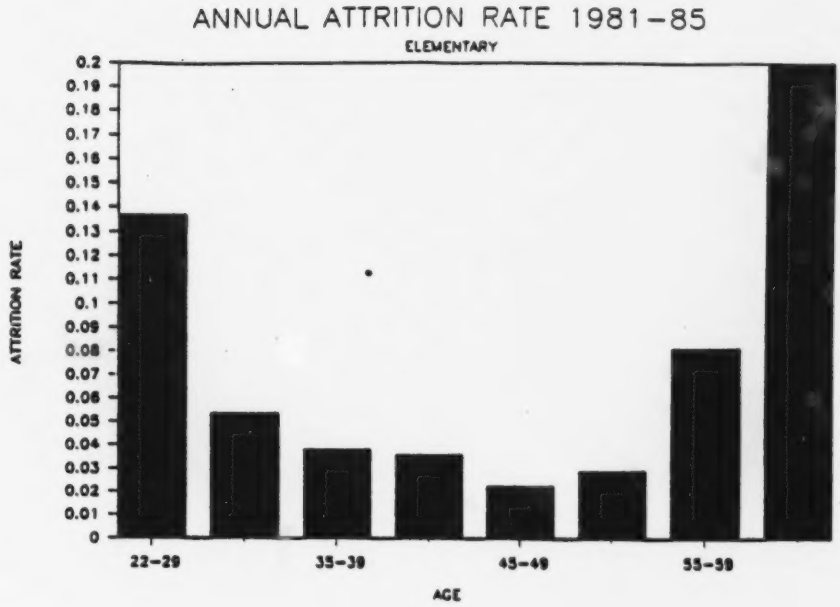
Fig. 4 -- Senior High Teacher Attrition Rates by Age and Year

Table 4

ATTRITION AND TRANSFERS BY CATEGORY, 1981-1985

Category	1981		1982 (Percent of total)		1983	
	Transfer to Another Category	Attrition	Transfer to Another Category	Attrition	Transfer to Another Category	Attrition
Elementary school	2.5	6.0	1.0	4.3	0.7	3.9
Junior high school	5.6	7.4	5.4	6.2	3.1	6.4
Senior high school	5.0	5.6	2.0	7.3	2.7	7.3
Career education	8.9	7.0	15.7	10.1	2.2	3.9
Special education	4.5	6.0	2.2	8.1	0.8	7.5
Other (codes F-K)	20.9	8.8	5.1	8.7	3.4	7.7

Category	1984 (Percent of total)		1985	
	Transfer to Another Category	Attrition	Transfer to Another Category	Attrition
Elementary school	1.3	5.5	2.3	3.8
Junior high school	4.7	7.0	6.5	5.0
Senior high school	3.1	6.4	5.9	4.5
Career education	3.4	7.0	13.0	5.9
Special education	1.3	8.1	1.9	5.6
Other (codes F-K)	6.3	11.2	3.0	11.3



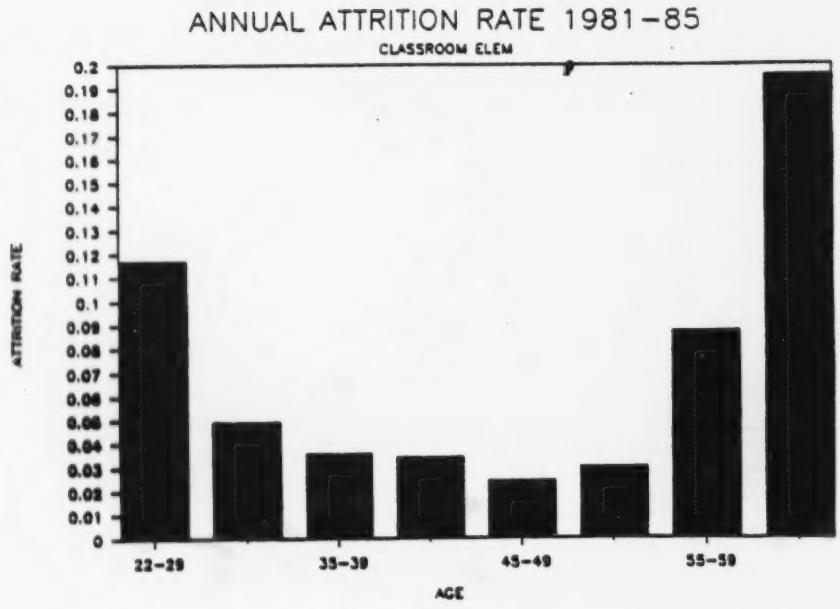
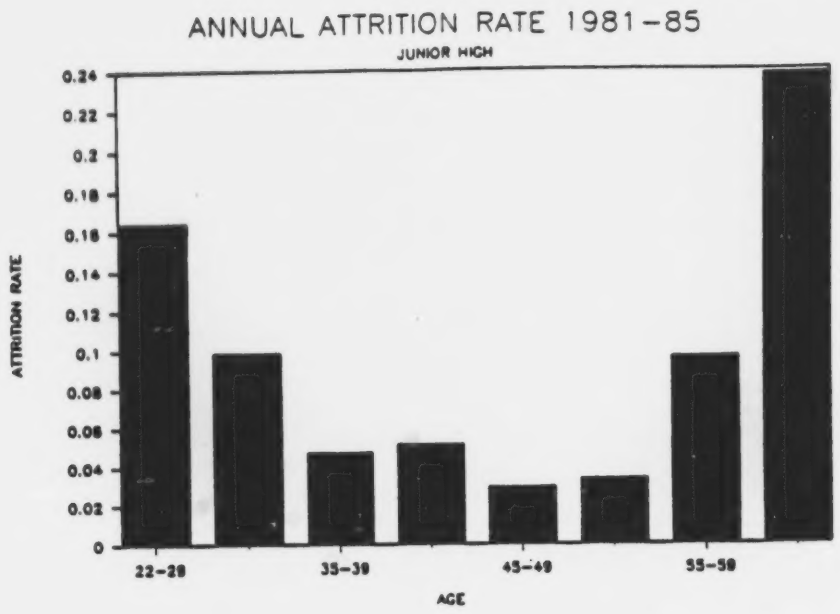


Fig. 5 -- Elementary and Special Education Teacher Attrition Rates by Age



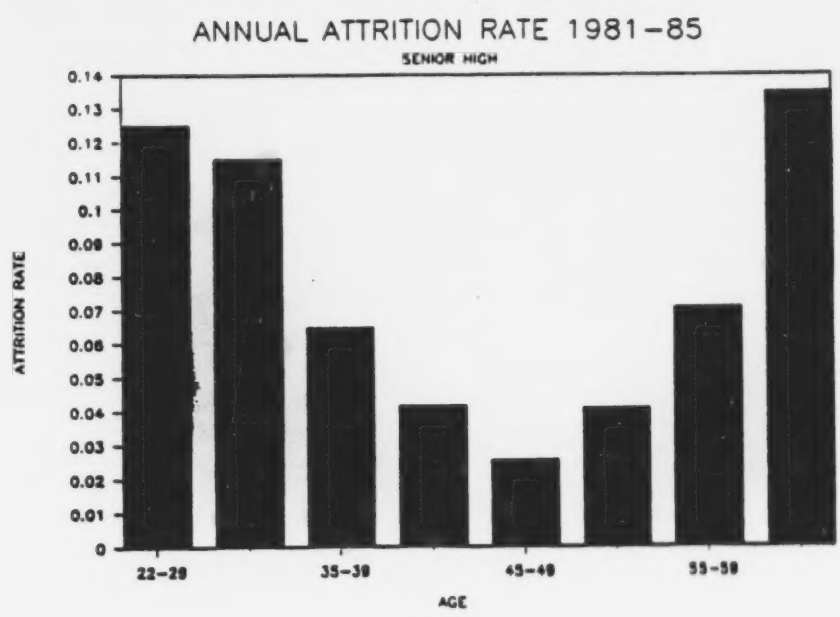


Fig. 6 -- Junior and Senior High Teacher Attrition Rates by Age

special education group where almost all teachers are hired from the below age 35 group. This may reflect the recent emphasis on the training and licensing of teachers for this specialty.

It will be important for the DCPS to analyze the reason for not hiring younger teachers. It may simply reflect a preference for mid-career teachers over young teachers with younger teachers not being heavily recruited. In this case the recruiting emphasis will have to be changed as the demand for teachers increases since it will be increasingly difficult to fill the demand with mid-career teachers. If however, the low number of young hires reflects poor acceptance of employment offers, then salary increases and other measures may be necessary to boost hiring success. In either case it will be important for DCPS to initiate policies and programs to attract and retain younger teachers.

Enrollment Trends

DCPS enrollments for prekindergarten, kindergarten, elementary (grade 1-6), junior (grade 7-9) and senior high (grade 10-12) have been projected. The greatest degree of uncertainty in these projections is at the elementary and pre-elementary levels, due to the uncertain fertility and migration rates, and enrollment decisions of parents. At prekindergarten levels attendance is not mandatory, but it has been increasing rapidly recently due to policy emphasis. From 1980 to 1987 enrollment has increased from around 2800 to 3400 students--an annual growth rate of 3.2 percent. This has been the fastest growing of all the grade levels. The projections assume a growth rate over the next six years similar to the years since 1980 (see Fig. 9).

For kindergarten the growth rate since 1980 has been around 1.8 percent annually. This probably reflects both increases in the population of children of kindergarten age, as well as an increased rate of choice to enroll children in public school kindergartens. First grade enrollments have increased at an annual growth rate of only 1.1 percent over the same period. The rate conforms closely to available data on fertility and migration trends in the district. It is clear that kindergarten attendance is more affected by individual parental

Table 5

ATTRITION AND TRANSFERS BY SUBJECT, 1981-1985

Subject	1981		1982 (Percent of total)		1983	
	Transfer to Another Subject	Attrition	Transfer to Another Subject	Attrition	Transfer to Another Subject	Attrition
Classroom Instruction						
Elementary 1-6	4.0	7.7	2.9	3.5	2.6	3.2
Preschool	7.0	4.3	7.1	4.7	4.1	5.4
Art and music	0.4	6.2	0.4	7.7	0.4	6.0
Physical education	1.9	6.5	1.7	5.8	0.4	5.0
Mathematics	7.5	3.4	2.2	8.8	1.1	6.3
Science	1.4	8.7	0.7	8.4	1.1	8.2
English	2.2	4.2	0.8	6.8	0.6	7.8
Social studies	3.7	3.7	0.4	5.8	0.5	1.8
Reading	17.9	5.5	4.2	4.2	11.8	4.8
Foreign language	2.2	7.8	1.1	11.9	0.0	12.5
Bilingual instruction	9.7	6.5	13.3	10.0	0.0	17.9
Resource programs	3.6	3.6	14.7	1.6	3.4	5.0
Other	20.6	32.4	17.5	15.0	25.0	6.3
Small Group Instruction	7.9	5.5	4.2	7.5	1.4	6.7
Vocational/Technical Instruction	1.3	6.8	0.5	5.2	0.3	6.5
General Instructional Support						
Counselors	1.2	5.3	1.7	5.5	0.0	3.0
Librarians	0.0	2.3	0.6	4.0	1.2	4.6
Other	33.3	4.2	10.4	6.3	13.2	3.8
All Others	17.9	9.4	3.4	11.9	5.5	10.0

Table 5 (Continued)

ATTRITION AND TRANSFERS BY SUBJECT, 1981-1985

Subject	1984 (Percent of total)		1985 (Percent of total)	
	Transfer to Another Subject	Attrition	Transfer to Another Subject	Attrition
Classroom Instruction				
Elementary 1-6	4.1	5.4	5.3	3.1
Preschool	4.5	5.0	6.3	3.6
Art and music	2.3	6.5	4.2	6.5
Physical education	3.0	3.5	1.3	3.6
Mathematics	2.6	6.6	6.5	4.7
Science	2.5	8.9	4.3	5.0
English	1.8	5.2	4.8	2.7
Social studies	1.8	5.5	1.9	3.8
Reading	3.8	5.6	11.7	3.9
Foreign language	2.1	12.4	2.9	7.8
Bilingual instruction	2.8	11.1	0.0	16.7
Resource programs	7.9	4.4	13.1	4.7
Other	16.0	8.0	9.7	12.9
Small Group Instruction	1.7	7.4	2.7	5.5
Vocational/Technical Instruction	2.8	6.1	2.4	4.7
General Instructional Support				
Counselors	0.4	7.4	1.3	7.1
Librarians	0.6	5.1	0.6	5.2
Other	18.8	14.6	3.9	11.8
All Others	3.3	14.7	5.4	8.5

Table 6

ATTRITION RATES BY CATEGORY AND SEX, 1981-1985

Category	Male		Female		
	Total (N)	Percent Attrition	Total (N)	Percent Attrition	Percent Difference*
Elementary school	1,294	6.0	12,950	4.6	30.4
Junior high school	1,630	7.2	3,880	6.1	18.0
Senior high school	1,525	5.8	2,547	6.3	-10.8
Career education	394	8.1	556	5.9	37.3
Special education	506	7.1	2,538	7.0	1.4
Other (codes F-K)	268	7.1	885	10.3	-31.1

*Difference between the male and female attrition rates as a percent of the female attrition rate.

Table 7

ATTRITION RATES BY AGE AND SEX, 1981-85

Age	Male		Female		
	Total	Percent Attrition	Total	Percent Attrition	Percent Difference*
21-25 years	--**	--	138	10.1	--
26-30 years	178	16.3	1,017	11.0	48.2
31-35 years	671	9.2	3,051	6.2	48.3
36-40 years	1,470	5.2	5,175	4.5	15.6
41-45 years	1,134	4.9	4,325	3.8	28.9
46-50 years	839	4.1	3,848	2.6	57.7
51-55 years	682	4.6	3,182	4.1	12.2
56-60 years	369	7.9	1,710	8.6	-8.1
61-65 years	200	12.5	667	15.6	-19.9
65+ years	56	41.1	243	43.6	-5.7
Average		6.9		5.6	23.2

*Difference between the male and female attrition rates as a percent of the female attrition rate.

**Sample size less than 50.

attrition rates than similarly aged females. Males have higher attrition rates than females at every age until retirement eligibility when females appear to retire somewhat earlier than males.

Male teachers have higher attrition rates across all subject areas except physical education, foreign language and counseling (see Table 8). Females, in particular, have significantly higher attrition rates than males in physical education.

The attrition patterns evident in DCPS are typical of those of other school systems for which similar analysis has been undertaken. In particular, the age specific trends, male/female differences and subject specific differences are quite predictable from a consideration of alternate labor market opportunities, retirement system vesting effects and a life cycle theory of career mobility. What separates the DCPS from other systems is an age distribution somewhat older than other school systems and the small percentage of younger teachers under age 30. This age distribution also results in attrition rates which are below those of other districts.

Characterizing New and Returning Teachers

In the last two years DCPS has accelerated hiring of new teachers (see Table 9). Eight percent of teachers were newly hired in 1986-87 compared to 6 percent in 1985-86 and 3.4 percent in 1984-85. This increased hiring was in each category of teaching and across most teaching areas (see Tables 10, 11 and 12).

The age distribution of new teachers reveals that these new or returning teachers are mostly between 30 to 45 years of age. In the last two years the largest number of elementary teachers hired were between 40 and 45 years of age (see Figs. 7 and 8). Few new teachers are under 30. While the main group of new or returning teachers is between age 30 and 45, significant numbers of teachers who are hired or return are between ages 46 and 65. Particularly striking is the increases in the number of teachers between ages 45 and 65 in 1986-87. Part of the increased demand for new teachers in the last two years appears to be satisfied by higher rates of teachers returning from retirement or leaves of absence. The exception to this trend is in

Table 8

ATTRITION RATES BY SUBJECT AND SEX, 1981-1985

Subject	Male		Female		
	Total (N)	Percent Attrition	Total (N)	Percent Attrition	Percent Difference*
Classroom Instruction					
Elementary	546	6.6	7,257	4.5	46.7
Preschool	61	4.9	1,909	4.6	6.5
Art and music	445	7.6	866	6.0	26.7
Physical education	684	3.5	517	6.8	-48.5
Mathematics	514	6.6	1,274	5.7	15.8
Science	584	8.1	809	7.7	5.2
English	237	5.5	1,477	5.4	1.9
Social studies	454	4.6	658	3.8	21.1
Reading	--**	--	880	4.9	--
Foreign language	119	9.2	359	10.9	-15.6
Bilingual instruction	--**	--	138	10.9	--
Resource programs	72	8.3	852	3.5	137.1
Other	81	18.5	115	18.3	1.1
Small Group Instruction	500	6.8	2,134	6.4	6.3
Vocational/Technical Instruction	769	6.4	1,192	5.5	16.4
General Instructional Support					
Counselors	198	5.1	968	5.8	-12.1
Librarians	--**	--	839	3.9	--
Other	--**	--	188	6.9	--
All Others	214	15.0	924	11.7	28.2

*Difference between male and female attrition rates as a percent of the female attrition rate.

**Sample size less than 50.

Table 9

NEW TEACHERS AS PROPORTION OF TOTAL TEACHERS, 1982-1986

Year	Total	Percent New Teachers
1982	5,723	2.41
1983	5,755	6.39
1984	5,684	3.40
1985	5,706	6.06
1986	5,962	8.03

Table 10

NEW HIRES AND TRANSFERS BY CATEGORY, 1982-1986

Category	1982		1983		1984	
	Transfer from Another Category	New Hire	Transfer from Another Category	New Hire	Transfer from Another Category	New Hire
Elementary school	1.7	2.4	0.9	5.2	0.4	2.7
Junior high school	9.4	2.2	3.8	6.2	3.5	3.1
Senior high school	6.9	2.1	5.9	7.6	3.3	3.9
Career education	10.9	1.6	11.1	7.2	4.3	3.2
Special education	2.2	4.1	0.7	10.6	1.2	6.2
Other (codes F-K)	15.9	1.9	7.7	6.8	1.8	4.5

Category	1985		1986	
	Transfer from Another Category	New Hire	Transfer from Another Category	New Hire
Elementary school	1.1	5.4	1.2	7.2
Junior high school	4.6	5.4	5.7	8.8
Senior high school	2.8	7.3	5.9	8.5
Career education	6.5	4.8	5.3	7.1
Special education	2.0	9.4	0.9	10.1
Other (codes F-K)	8.1	4.7	22.0	8.2

Table 11

NEW HIRES AND TRANSFERS BY SUBJECT

Subject	Percent Transfers from Another Subject	Percent New Hires
Classroom Instruction		
Elementary	3.0	4.2
Preschool	6.2	5.9
Art and music	1.5	6.1
Physical education	1.4	3.8
Mathematics	1.5	6.6
Science	2.0	7.1
English	1.8	5.6
Social studies	0.5	4.7
Reading	3.3	4.6
Foreign language	3.2	8.2
Bilingual instruction	5.3	8.2
Resource programs	18.4	3.7
Other	20.8	5.4
Small Group Instruction	2.3	7.6
Vocational/Technical Instruction	2.7	4.1
General Instructional Support		
Counselors	4.4	4.3
Librarians	2.0	4.6
Other	21.3	7.4
All Others	8.0	13.0

Table 12

NEW HIRES AND TRANSFERS BY SUBJECT, 1982-1986

Subject	1982		1983		1984	
	Transfer from Another Subject	New Hire	Transfer from Another Subject	New Hire	Transfer from Another Subject	New Hire
Classroom Instruction						
Elementary 1-6	5.4	2.9	3.7	4.3	1.8	2.9
Preschool	5.5	1.8	8.9	7.9	3.4	3.9
Art and music	2.3	3.1	1.2	5.1	0.4	2.3
Physical education	2.8	1.2	1.2	7.3	0.0	1.3
Mathematics	2.2	3.5	1.4	8.3	0.3	3.9
Science	4.2	2.6	1.5	8.0	0.7	4.8
English	2.3	1.7	0.6	5.5	1.2	3.6
Social studies	0.4	1.3	0.0	5.0	0.5	2.3
Reading	5.2	1.6	2.1	5.7	1.9	0.6
Foreign language	2.3	4.6	3.3	8.7	0.0	4.6
Bilingual instruction	7.1	0.0	3.3	20.0	11.5	0.0
Resource programs	34.0	1.5	6.2	3.9	16.8	2.5
Other	15.8	0.0	9.1	9.1	7.7	7.7
Small Group Instruction	2.4	4.2	2.1	10.7	2.3	6.5
Vocational/Technical Instruction	4.1	1.3	1.8	6.1	2.3	2.5
General Instructional Support						
Counselors	3.4	0.4	1.2	7.1	1.7	3.4
Librarians	3.4	1.7	0.6	5.1	3.9	4.5
Other	63.8	4.3	10.6	4.3	6.3	2.1
All Others	7.3	2.4	8.6	7.1	3.0	3.5

Table 12 (Continued)

NEW HIRES AND TRANSFERS BY SUBJECT, 1982-1986

Subject	1985		1986	
	Transfer from Another Subject	New Hire	Transfer from Another Subject	New Hire
Classroom Instruction				
Elementary 1-6	1.9	4.6	2.3	6.4
Preschool	7.9	7.4	5.3	7.9
Art and music	0.8	7.7	2.6	12.0
Physical education	0.9	4.0	2.2	5.2
Mathematics	1.5	6.2	2.3	11.2
Science	1.1	9.0	2.4	10.6
English	2.1	7.1	2.9	9.7
Social studies	0.9	6.0	0.5	9.2
Reading	2.5	7.5	4.7	8.1
Foreign language	2.2	8.6	7.0	13.2
Bilingual instruction	8.3	5.6	0.0	11.8
Resource programs	14.4	2.8	19.6	7.1
Other	36.4	6.1	31.6	5.3
Small Group Instruction	2.3	7.1	2.1	9.3
Vocational/Technical Instruction	1.8	4.7	3.3	5.9
General Instructional Support				
Counselors	3.0	5.6	12.5	4.8
Librarians	0.6	5.7	1.7	6.2
Other	18.6	7.0	10.2	16.9
All Others	8.9	10.8	13.9	7.0

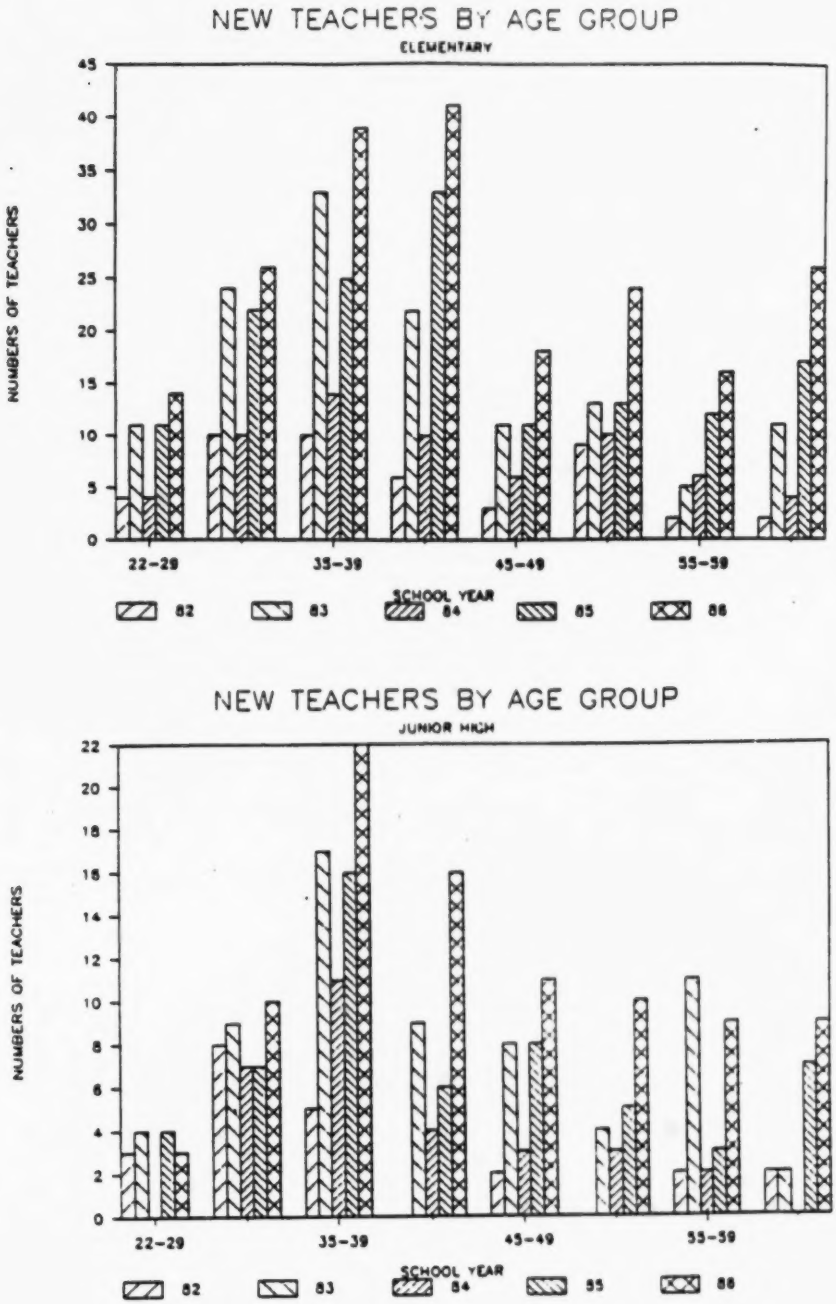


Fig. 7 -- New Elementary and Junior High Teachers by Age and Year

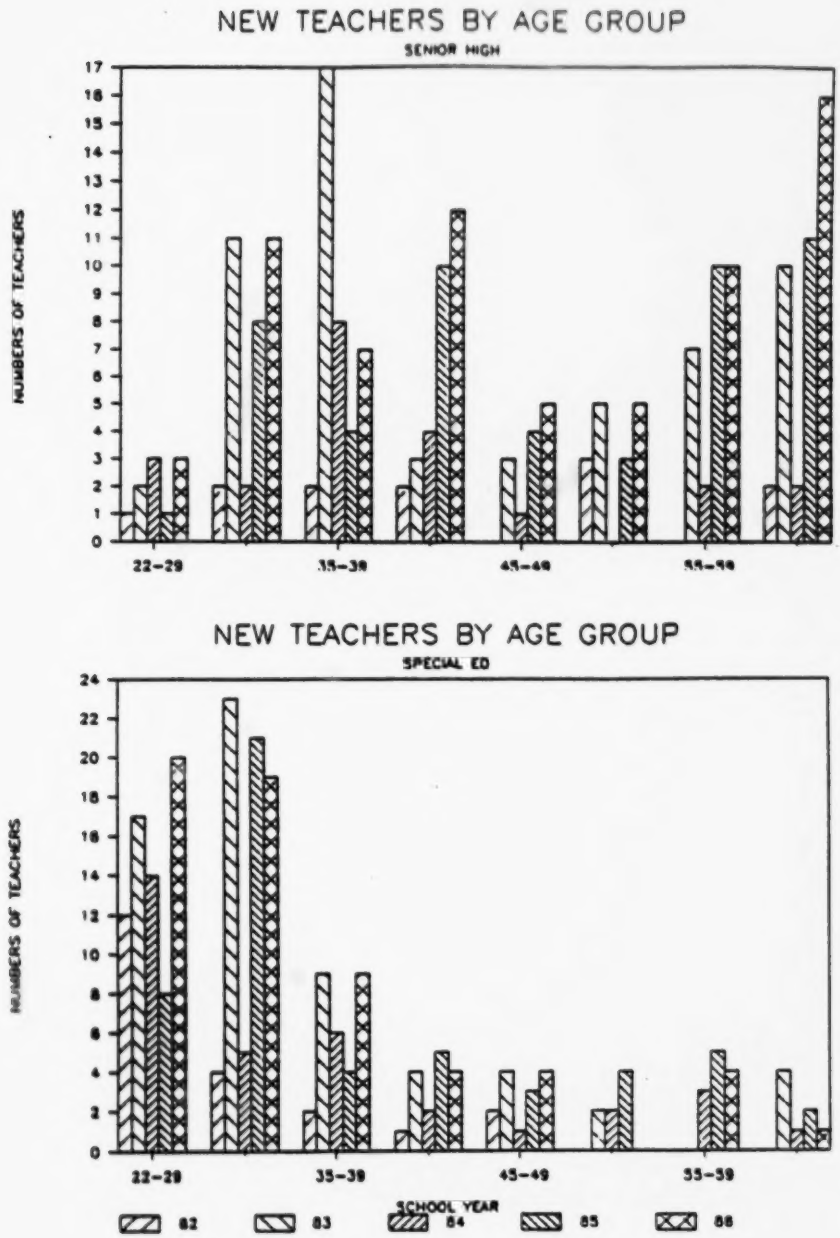
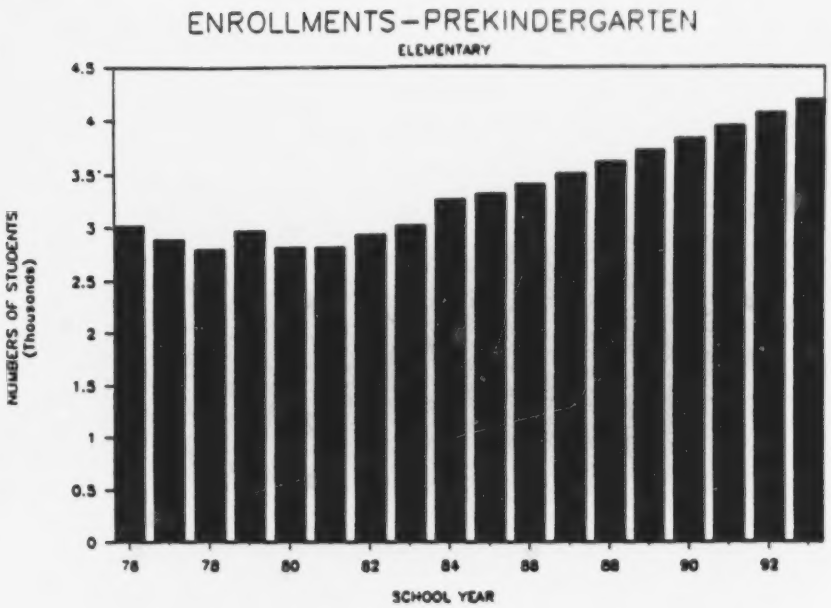


Fig. 8 -- New Senior High and Special Education Teachers by Age and Year



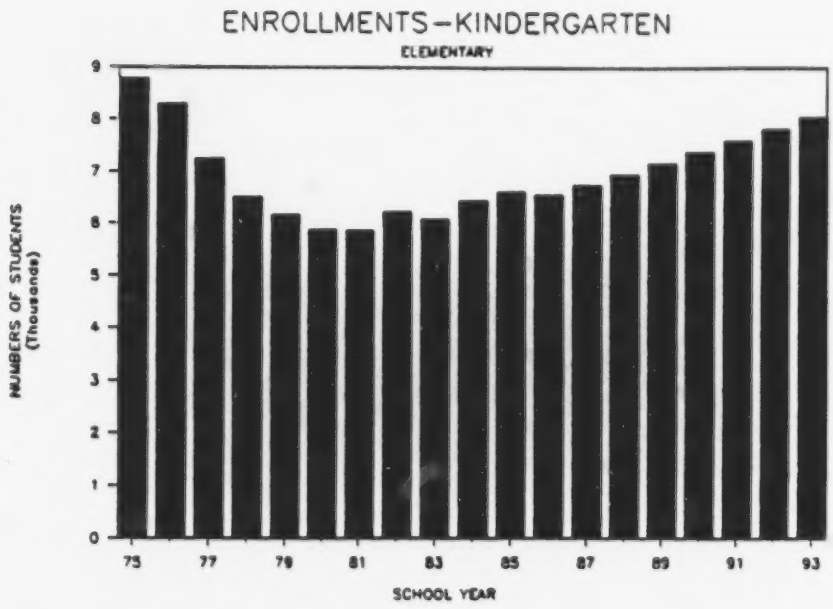


Fig. 9 -- Enrollment Projections for Pre-Elementary Students

decisions and, therefore, more uncertainity exists in projecting this group than the first grade group. For this reason a high and low growth assumption regarding attendance at kindergarten and first grade have been made.

National fertility trends for black Americans show strong growth in the number of school age children over the next 8 years. The growth rate from 1986 to 1993 is projected to be between 2 and 3 percent. It cannot be simply assumed that the District will mirror national trends since there are different migration rates and patterns of fertility in the District. District migration trends recently have shown a net outmigration of about 1 percent annually. Recent live birth rate data in the District also indicate a somewhat slower growth than national trends for black Americans. Therefore, a 1 percent growth rate has been used for the low growth assumption and 3 percent growth rate for the high growth assumption. The lower growth rate will be more accurate if net outmigration continues in the District and District fertility trends stay below national trends for Black Americans. The higher level will be more accurate if net migration trends turn positive and/or fertility trends match or exceed national trends.

Enrollments for grades 2 through 12 are projected by assuming that school continuance and migration patterns for 1985-86 will continue. This assumes that there will be no drastic change in parental decision choices between public and private schools, no change in school drop-out rates, and little change in migration patterns. If necessary the projection model allows for easy modification of the assumption and new rates of teacher needs can be calculated.

Figures 9, 10, and 11 display the historical enrollment rates and the resulting projections through 1993. Two projections for elementary levels have been shown, corresponding to the one and three percent growth assumptions at kindergarten and first grade level. For junior and senior high a single projection is shown since any expected differences during this time period will be very small. Junior and senior high enrollments are projected to increase only slightly between 1987 and 1993, but both will increase significantly after that time.

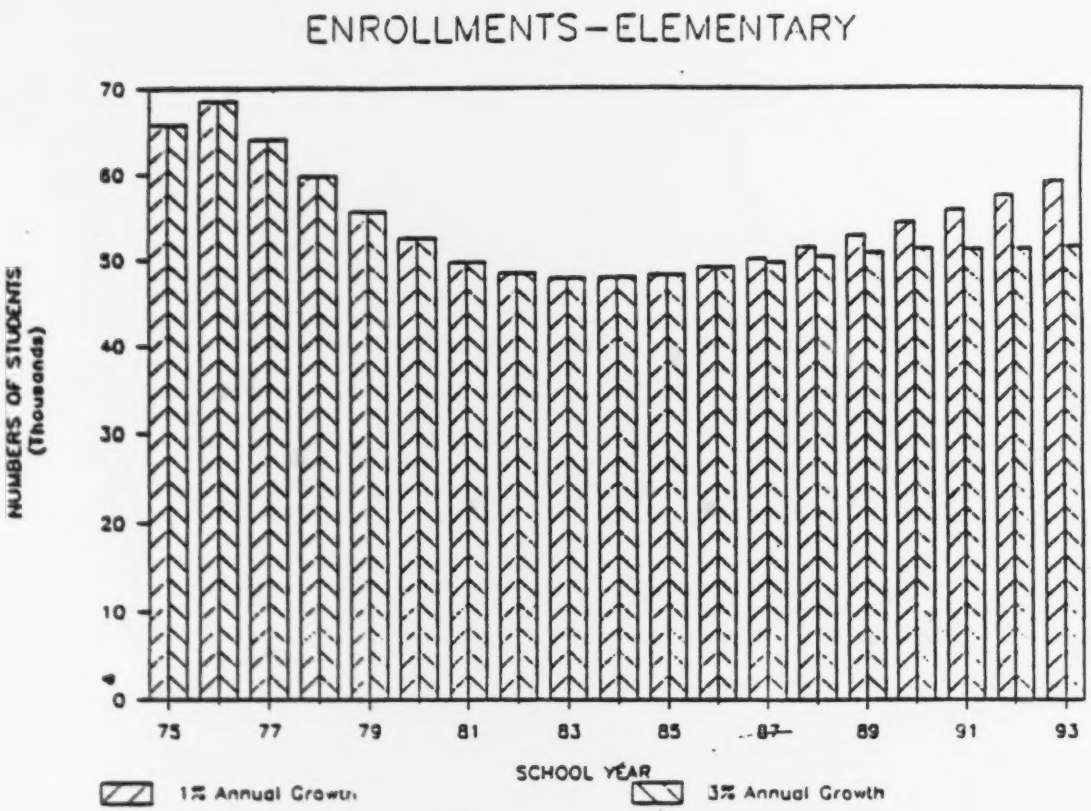


Fig. 10 -- Elementary Enrollment Projections

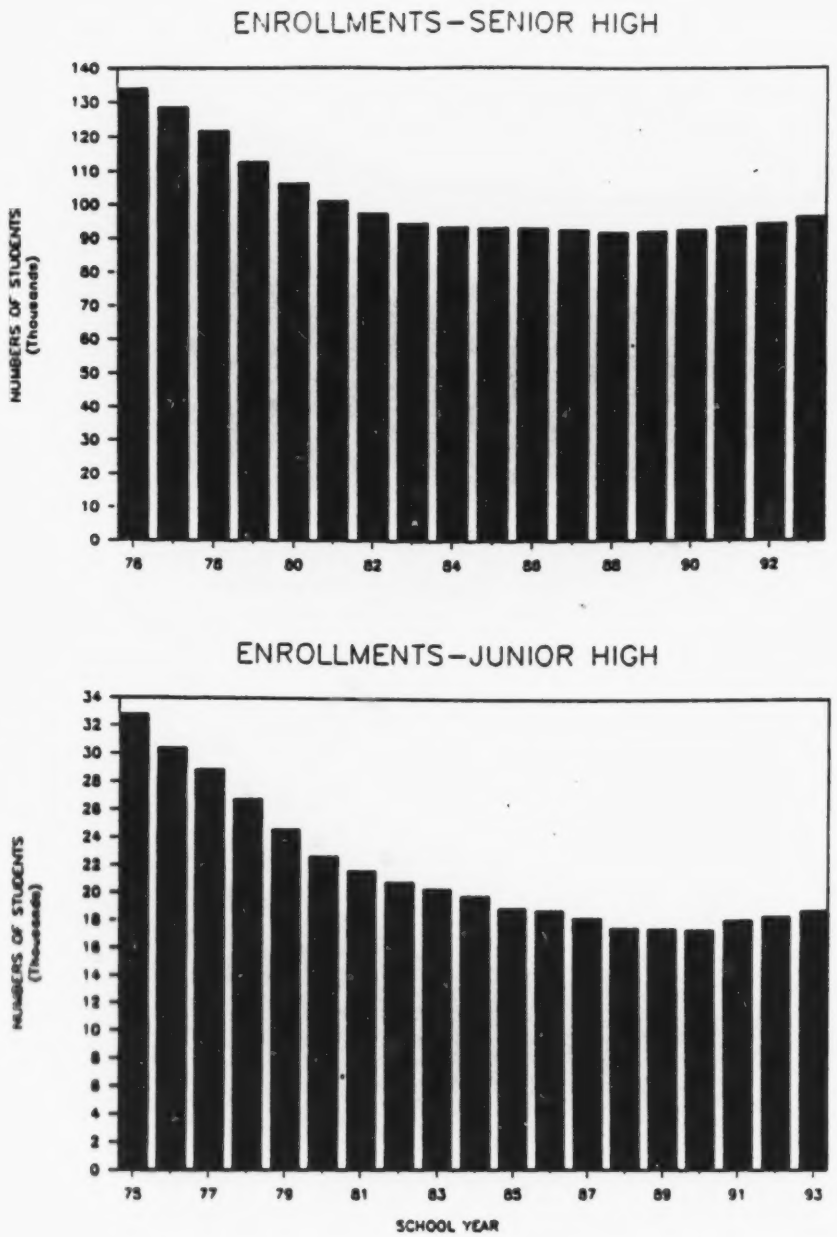


Fig. 11 -- Junior and Senior High Enrollment Projections

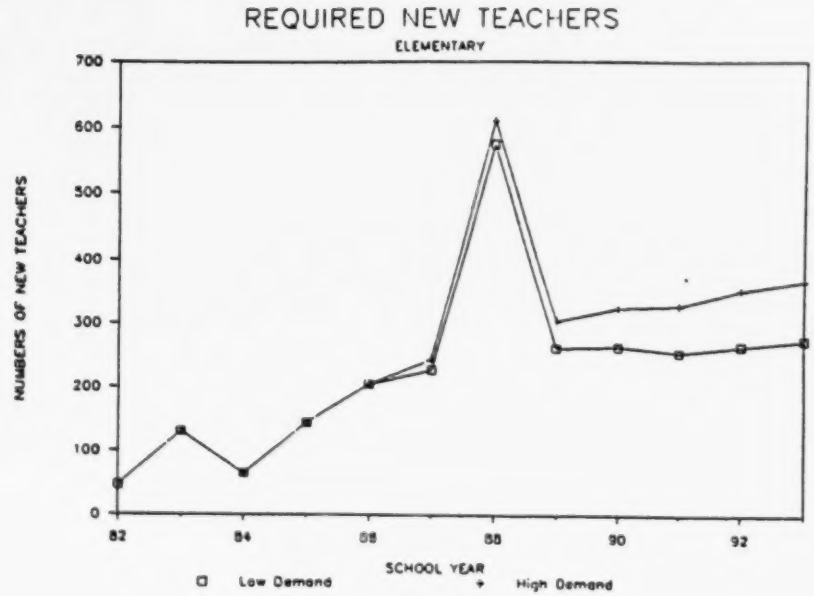
Student/Teacher Ratios

The projection model has assumed that DCPS will be able to carry out its stated policies for class size during the next seven years. Specifically, it was assumed that class size for kindergarten, first and second grade will be reduced from 25 to 20 students by 1988. It was further assumed that English and mathematics classes in junior and senior highs also will be reduced from 25 to 20 in 1988. For other classes and grades a constant class size over the time period has been normal. Changing class sizes has the largest effect on hiring requirements. Different assumptions for class size can easily be introduced in the model and the consequences for hiring of new teachers determined.

Hiring Requirements for New Teachers

New teachers are required to fill vacanies of leaving teachers, to teach increasing number of students and to staff smaller class sizes. If no teachers left each year, enrollments did not increase and, class sizes stayed constant, then no new teachers would be required. However, about 5 percent of teachers leave each year, so DCPS must hire at least 5 percent of the teaching staff new each year. Increasing enrollments also bring, an additional demand, above the 5 percent level for new teachers, and mandating smaller class sizes further increases the demand for new teachers.

At the elementary level between 1982 and 1985, an average of about 100 new teachers was sufficient to meet requirements. This number has now risen to slightly above 200 over the last two years as enrollments at lower elementary grades and pre-elementary grades have risen. If the mandate for smaller class sizes at elementary grades is to be met in 1988, a need for almost 600 new teachers is projected (see Fig. 12). If DCPS is able to meet that demand in 1988, then demand will drop to about 260 to 340 elementary teachers per year between 1989 and 1993. If the demand for 600 in 1988 is not met, then the excess need will be carried over to future years.



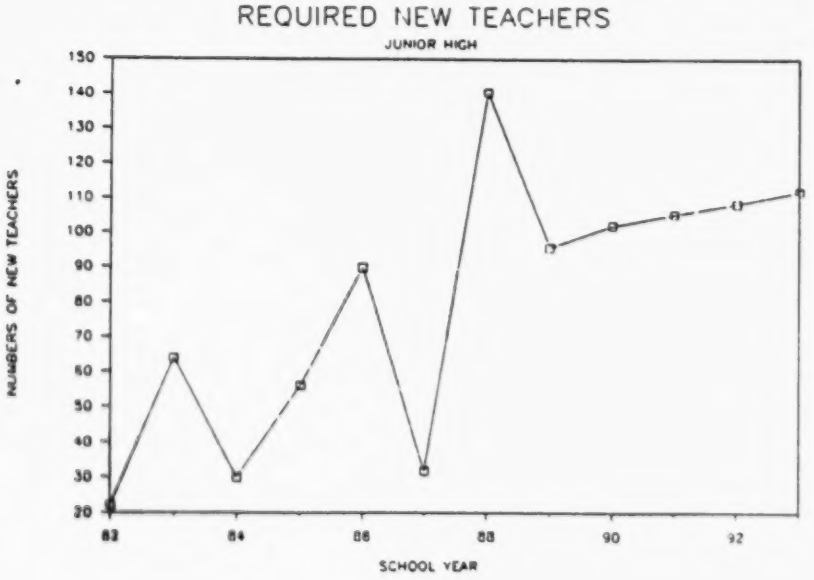


Fig. 12 -- Required New Teachers at Elementary and Junior High

The different growth rate assumptions of one and three percent make a modest difference in new teacher demand after 1989. Under the lower growth assumption about 260 teachers annually would be required, while under the higher growth assumption about 350 would be required. These projections have assumed that hiring more teachers will require the hiring of more young teachers. Thus, the higher attrition rates associated with younger teachers have been built into the projections.

At the junior high level, between 1982 and 1985 about 45 new teachers per year were hired (see Fig. 12). To meet the smaller English and mathematics class sizes in 1988 a need for 140 new junior high teachers is projected. All of the increase would be for math and English teachers. After 1989 demand for all types of junior high teachers would be around 100 new teachers a year. For senior high a similar pattern prevails. Between 1982 and 1985 about 35 new teachers annually were required (see Fig. 13). This jumps to slightly over 100 in 1988 to fill requirements for smaller English and math classes. After 1989 annual demand falls to around 70 teachers per year.

Demand for special education teachers stays fairly close to historical levels (see Fig. 13). Between 1982 and 1985 about 45 new teachers were required annually. A fairly constant requirement of around 50 teachers a year from 1988 to 1993 is projected. This assumes there will be no significant changes in enrollments or class size for special education classes.

Exploring Different Student/Teacher Ratios

This section indicates how the projection model can be used to explore the impacts of different student/teacher ratios, and changes in the pace with which different goals for student/teacher ratios are met. The example given uses elementary school teachers. The demand for new teachers is derived under three different student/teacher ratios. The first hold student/teacher ratios in the early grades at current levels of 25 pupils per class. The second assumes that average class size will be 22.5 in the early grades. The third scenario assumes the current policy of 20 pupils per class. Figure 14 shows the new teacher demand for each of these three scenarios.

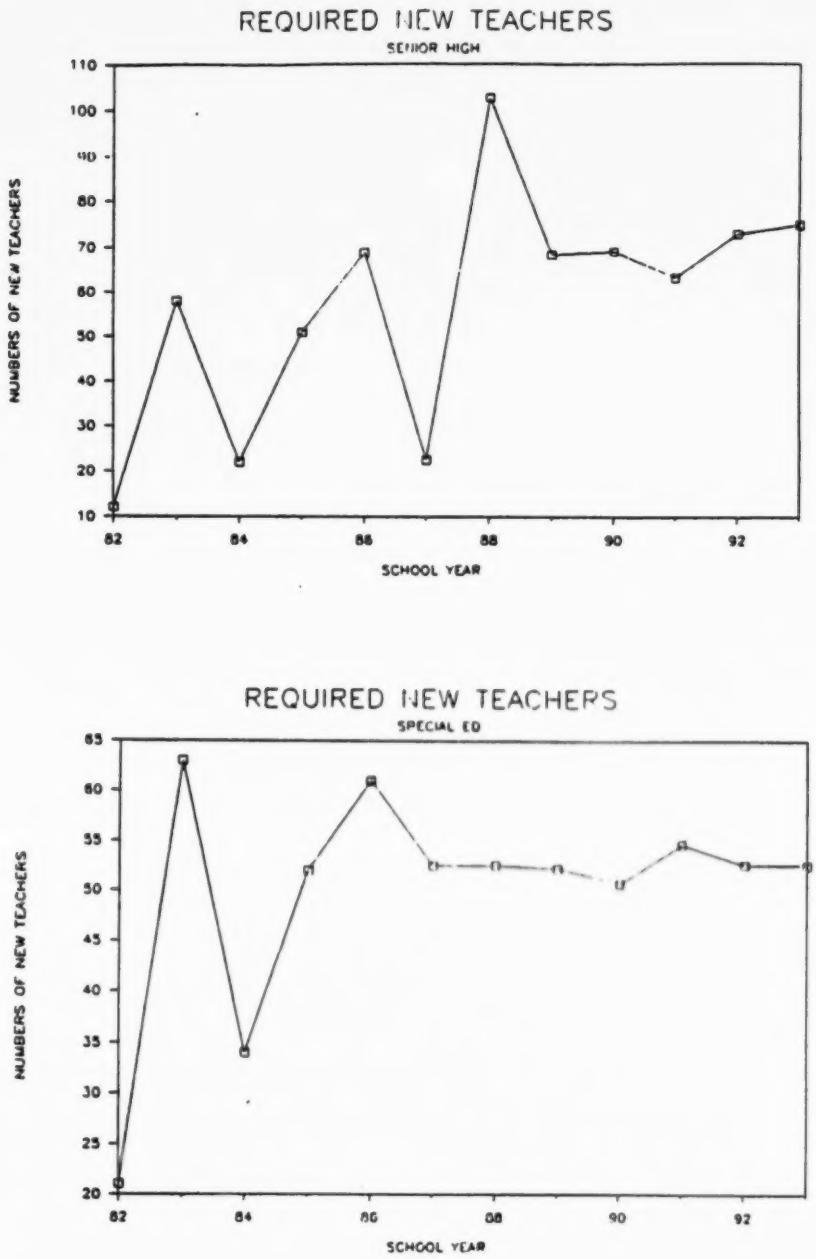


Fig. 13 -- Required New Teachers at Senior High and Special Education

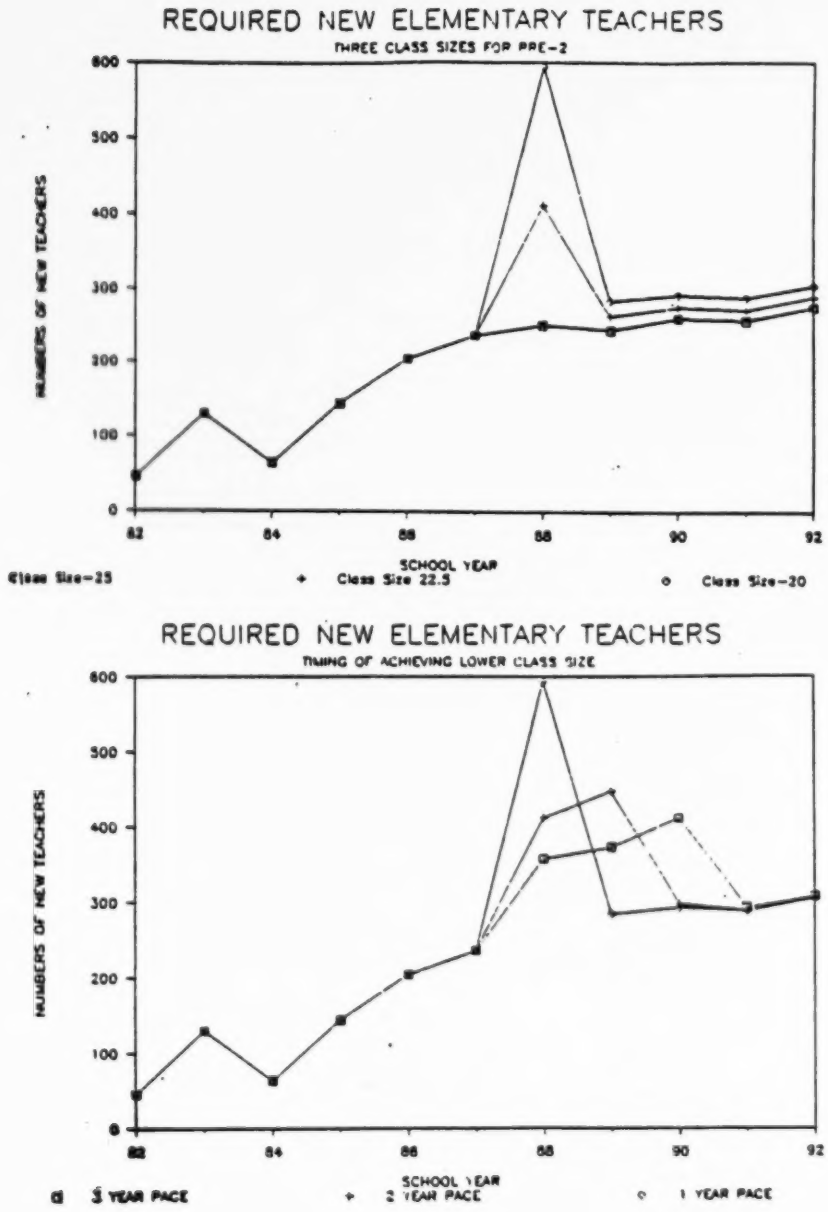


Fig. 14 -- Required New Teachers Under Different Class Size Assumptions

The major impact is in the first year in which the policy of smaller class sizes is implemented. In 1988 the demand for new teachers declines strongly. Basically, the results show that reducing class size requires a large infusion of teachers in the year in which class sizes decline, but the longer term impact on teacher demand is relatively small.

This suggests alternative approach to achieving smaller class sizes. To avoid a precipitous increase in demand in one year, smaller class sizes could be phased in over three years. Figure 14 also shows new teacher demand if the smaller class sizes of 20 were achieved in equal steps by 1990 rather than 1988. One advantage of this approach is that it eases the personnel problems associated with such a precipitous increase. The most significant of these problems is that it may be difficult to find enough quality teachers in one year to meet demand. A three year phase-in would allow better screening of new teachers, and would probably result in an overall higher quality of teachers. A second advantage is that the need for recruiting and personnel resources necessary to fill these positions would be eased, and allow more time for developing successful recruiting strategies. A final advantage would be that such an approach would permit the supply market time to adjust to the additional demands. School of education enrollments have been declining from 1973 to 1985. Only recently have they turned upward.

Conclusions and Policy Implications

The District School system faces an unprecented challenge in recruiting and retaining sufficient teachers to meet expanding enrollments, smaller class sizes and higher attrition rates. We have analyzed new teacher demand for elementary, junior high, senior high and special education teachers. Of these four the most serious problem will be meeting the demand for new elementary school teachers. Mathematics and English teachers at the high school level will also pose problems because of increased demand. There will be some increased demand for junior high teachers, but no increased demand for special education teachers.

Between 1982 and 1985 the District hired an average of approximately 100 new elementary teachers per year. This number would be approximately 300 per year between 1989 and 1993 even if class sizes were to remain constant. However, the smaller class sizes mandated by the Board below grade three will mean that in 1988 approximately 550 new teachers will have to be hired. In 1986 approximatley 200 elementary teachers were hired, but a significant number of these appeared to be teachers returning from leave and retirement. As the pool of these teachers is exhausted, the district will have to increasingly depend on hiring teachers from outside the district and new young graduates.

In meeting these requirements, it will be difficult to maintain high quality standards for new teachers. The tendency might be to meet hiring requirements with little consideration for quality of new teachers. To maintain both quality and meet new teacher demand will require consideration of several initiatives. . These include:

- higher salaries for teachers--particularly younger teachers;
- effective programs to retain younger teachers;
- expanded resources for recruiting new teachers together with expanded geographical selection of schools for recruiting;
- incentives to delay early retirement for teachers;
- internal incentives for personnel qualified to teach elementary levels, but not presently teaching elementary school, to transfer into elementary teaching;
- easing of requirements for new teachers to immediately find residence in the District--perhaps a grace period of two years until a more permanent commitment to teaching in the District is made;
- partial scholarships at selected schools for commitment of time teaching in the District; and
- accepting more years of experience for incoming teachers with previous experience when determining placement on salary scales and retirement vesting.

Each of these measures would expand the supply of teachers, but there is great uncertainity associated with the costs and benefits of each method. The costs of each of the methods is easier to calculate than the benefits. For instance the costs of giving pay raises across the board to teachers is easily calculated. However, the number of additional new teachers that would be attracted by higher salaries, and the number of additional teachers who would not quit due to the increased salary is a difficult statistical problem. Since answers to these questions are not going to be available soon, the District needs to probably begin implementation of some of the lower costs options, and evalaute results over time before proceeding to the higher cost options.

Since enrollment projections and attrition rates are uncertain annual re-evaluations will be required to re-estimate key parameters of the model. The model can also be used to evaluate the effects of new policies such as salary increases and even smaller class sizes. It remains a tool to aid the process of planning and evaluation.